AMENDMENTS TO THE CLAIMS

Claims 1-58. (Canceled)

59. (New) An ultrasonic sensor for performing transmission or reception of an ultrasonic wave to or from a circumjacent space filled with a fluid, comprising:

an ultrasonic transducer; and

a propagation medium portion, between said ultrasonic transducer and the circumjacent space, for forming a propagation path of the ultrasonic wave,

wherein a density ρ_1 of said propagation medium portion, an acoustic velocity C_1 obtainable in said propagation medium portion, a density ρ_2 of the fluid that fills the circumjacent space, and an acoustic velocity C_2 obtainable in the fluid that fills the circumjacent space satisfy a relation expressed as $(\rho_2/\rho_1) < (C_1/C_2) < 1$.

60. (New) The ultrasonic sensor according to claim 59, wherein

said propagation medium portion has a first surface region that faces an ultrasonic vibration surface of said ultrasonic transducer, and a second surface region that faces the fluid that fills the circumjacent space, with said second surface region being inclined relative to said first surface region.

61. (New) An ultrasonic sensor for performing transmission or reception of an ultrasonic wave to or from a circumjacent space filled with a fluid, comprising:

an ultrasonic transducer;

a propagation medium portion, between said ultrasonic transducer and the circumjacent space, for forming a propagation path of the ultrasonic wave; and

a reflector in contact with said propagation medium portion for controlling the propagation path of the ultrasonic wave,

wherein a density ρ_1 of said propagation medium portion, an acoustic velocity C_1 obtainable in said propagation medium portion, a density ρ_2 of the fluid that fills the circumjacent space, and an acoustic velocity C_2 obtainable in the fluid that fills the circumjacent space satisfy a relation expressed as $(\rho_2/\rho_1) < (C_1/C_2) < 1$.

62. (New) An ultrasonic sensor for performing transmission or reception of an ultrasonic wave to or from a circumjacent space filled with a fluid, comprising:

an ultrasonic transducer;

a propagation medium portion, between said ultrasonic transducer and the circumjacent space, for forming a propagation path of the ultrasonic wave; and

a reflector in contact with said propagation medium portion for controlling the propagation path of the ultrasonic wave,

wherein a density ρ_1 of said propagation medium portion, an acoustic velocity C_1 obtainable in said propagation medium portion, a density ρ_2 of the fluid that fills the circumjacent space, and an acoustic velocity C_2 obtainable in the fluid that fills the circumjacent space satisfy a relation expressed as $(\rho_2/\rho_1) < (C_1/C_2) < 1$, and

wherein said propagation medium portion has a first surface region that faces an ultrasonic vibration surface of said ultrasonic transducer, a second surface region that faces the fluid that fills the circumjacent space, and at least one third surface region between said first surface region and said second surface region in the propagation path of the ultrasonic wave and in contact with said reflector, with said second surface region being inclined with respect to at least one of said first surface region and said at least one third surface region.

63. (New) The ultrasonic sensor according to claim 62, wherein

a direction of the transmission or reception of the ultrasonic wave is almost parallel to said second surface region.

64. (New) An ultrasonic sensor for performing transmission or reception of an ultrasonic wave to or from a circumjacent space filled with a fluid, comprising:

an ultrasonic transducer; and

a propagation medium portion, filled in a space between said ultrasonic transducer and the circumjacent space, for forming a propagation path of the ultrasonic wave,

wherein a density ρ_1 of said propagation medium portion, an incident angle θ_1 of the ultrasonic wave relative to a direction that is normal to an interface between said

propagation medium portion and the fluid that fills the circumjacent space, a density ρ_2 of the fluid that fills the circumjacent space, and an approach angle θ_2 of the ultrasonic wave relative to the direction that is normal to the interface almost satisfy a relation expressed as $\rho_2/\rho_1 = \cot\theta_2/\cot\theta_1$.

65. (New) The ultrasonic sensor according to claim 64, wherein

said propagation medium portion comprises one of an organic polymer and a dry gel.

66. (New) The ultrasonic sensor according to claim 65, wherein

a solid frame portion of said dry gel is hydrophobic.

67. (New) The ultrasonic sensor according to claim 65, wherein

a density of said dry gel is not greater than 500 kg/m^3, and a mean pore diameter of said dry gel is not greater than 100 nm.

68. (New) The ultrasonic sensor according to claim 59, further comprising:

an acoustic matching layer, between said ultrasonic transducer and said propagation medium portion, for acoustically matching said ultrasonic transducer with said propagation medium portion.

69. (New) The ultrasonic sensor according to claim 64, wherein

the fluid that fills the circumjacent space is a gas, with the density ρ_2 being no greater than 10 kg/m^3.

70. (New) An ultrasonic flowmeter comprising:

a flow measurement section having an inner wall that defines a channel for a fluid to be measured;

an ultrasonic transducer provided outside said channel for performing transmission or reception of an ultrasonic wave; and

a propagation medium portion between said ultrasonic transducer and said channel for forming a propagation path of the ultrasonic wave,

wherein a density ρ_1 of said propagation medium portion, an acoustic velocity C_1 obtainable in said propagation medium portion, a density ρ_2 of the fluid to be measured, and an acoustic velocity C_2 obtainable in the fluid to be measured satisfy a relation expressed as $(\rho_2/\rho_1) < (C_1/C_2) < 1$.

71. (New) The ultrasonic flowmeter according to claim 70, further comprising:

another ultrasonic transducer provided outside said channel for performing transmission or reception of the ultrasonic wave; and

another propagation medium portion between said another ultrasonic transducer and said channel for forming a propagation path of the ultrasonic wave,

wherein a density ρ_1 of said another propagation medium portion, an acoustic velocity C_1 obtainable in said another propagation medium portion, the density ρ_2 of the fluid to be measured, and the acoustic velocity C_2 obtainable in the fluid to be measured satisfy the relation expressed as $(\rho_2/\rho_1) < (C_1/C_2) < 1$,

with said ultrasonic transducer being arranged so as to emit an ultrasonic wave to said another ultrasonic transducer, and with said another ultrasonic transducer being arranged so as to emit an ultrasonic wave to said ultrasonic transducer.

72. (New) The ultrasonic flowmeter according to claim 70, wherein

said propagation medium portion has a first surface region that faces an ultrasonic vibration surface of said ultrasonic transducer, and a second surface region that faces said channel, with said second surface region being inclined relative to said first surface region.

73. (New) The ultrasonic flowmeter according to claim 72, wherein

said first surface region is inclined in a direction of flow velocity of the fluid to be measured in said channel, and said second surface region is parallel to the direction of flow velocity of the fluid to be measured in said channel.

74. (New) The ultrasonic flowmeter according to claim 72, wherein

said second surface region forms substantially no difference in level between said second surface region and said inner wall of said flow measurement section.

75. (New) The ultrasonic flowmeter according to claim 70, wherein

said propagation medium portion comprises one of an organic polymer and a dry gel of an inorganic oxide.

76. (New) The ultrasonic flowmeter according to claim 75, wherein

a solid frame portion of said dry gel is hydrophobic.

77. (New) The ultrasonic flowmeter according to claim 76, wherein

a density of said dry gel is not greater than 500 kg/m^3, and a mean pore diameter of said dry gel is not greater than 100 nm.

78. (New) The ultrasonic flowmeter according to claim 70, wherein

the fluid to be measured is a gas, with the density ρ_2 being no greater than 10 $kg \cdot m^{-3}$.

79. (New) The ultrasonic flowmeter according to claim 70, further comprising:

an acoustic matching layer, between said ultrasonic transducer and said propagation medium portion, for acoustically matching said ultrasonic transducer with said propagation medium portion.

80. (New) The ultrasonic flowmeter according to claim 70, wherein

a size of said channel, measured in a direction perpendicular to a direction of flow velocity of the fluid to be measured, is not greater than a half wavelength of the ultrasonic wave at a central frequency in the fluid to be measured.

81. (New) The ultrasonic flowmeter according to claim 70, wherein said ultrasonic transducer is to form a convergence sound field.

82. (New) An apparatus comprising:

the ultrasonic flowmeter as recited in claim 70;

a pipe for supplying the fluid to be measured to said ultrasonic flowmeter; and

a display section for displaying a flow rate as measured by said ultrasonic flowmeter.

83. (New) An ultrasonic flowmeter comprising:

a flow measurement section having an inner wall that defines a channel for a fluid to be measured;

an ultrasonic transducer provided outside said channel for performing transmission or reception of an ultrasonic wave; and

a propagation medium portion between said ultrasonic transducer and said channel for forming a propagation path of the ultrasonic wave,

wherein a density ρ_1 of said propagation medium portion, an acoustic velocity C_1 obtainable in said propagation medium portion, a density ρ_2 of the fluid to be measured, and an acoustic velocity C_2 obtainable in the fluid to be measured satisfy a relation expressed as $(\rho_2/\rho_1) < (C_1/C_2) < 1$, and

wherein the density ρ_1 of said propagation medium portion, an incident angle θ_1 of the ultrasonic wave relative to a direction normal to an interface between said propagation medium portion and the fluid to be measured, the density ρ_2 of the fluid to be measured, and an approach angle θ_2 of the ultrasonic wave relative to the direction normal to the interface almost satisfy a relation expressed as $\rho_2/\rho_1 = \cot\theta_2/\cot\theta_1$.

84. (New) An ultrasonic flowmeter comprising:

a flow measurement section having an inner wall that defines a channel for a fluid to be measured, with a size of said channel, measured in a direction perpendicular to a direction of flow velocity of the fluid to be measured, is not greater than a half wavelength of an ultrasonic wave at a central frequency in the fluid to be measured;

an ultrasonic transducer provided outside said channel for performing transmission or reception of the ultrasonic wave; and

a propagation medium portion between said ultrasonic transducer and said channel for forming a propagation path of the ultrasonic wave, with a first surface region of said propagation medium portion being curved so as to form a lens surface,

wherein a density ρ_1 of said propagation medium portion, an acoustic velocity C_1 obtainable in said propagation medium portion, a density ρ_2 of the fluid to be measured, and an acoustic velocity C_2 obtainable in the fluid to be measured satisfy a relation expressed as $(\rho_2/\rho_1) < (C_1/C_2) < 1$.

85. (New) An ultrasonic flowmeter comprising:

a flow measurement section having an inner wall that defines a channel for a gas;

a first ultrasonic transducer provided outside said channel for performing transmission or reception of an ultrasonic wave;

a first propagation medium portion between said first ultrasonic transducer and said channel for refracting a propagation path of the ultrasonic wave, said first propagation medium portion including a first surface region that faces an ultrasonic vibration surface of said first ultrasonic transducer and a second surface region that faces said channel, with said first surface region being inclined in a direction of flow velocity of the gas in said channel, and with said second surface region being almost parallel to the direction of flow velocity of the gas in said channel;

a second ultrasonic transducer provided outside said channel for performing transmission or reception of the ultrasonic wave; and

a second propagation medium portion between said second ultrasonic transducer and said channel for refracting a propagation path of the ultrasonic wave, said second propagation medium portion including a third surface region that faces an ultrasonic vibration surface of said second ultrasonic transducer and a fourth surface region that faces said channel, with said third surface region being inclined in the direction of flow velocity of the gas in said channel, and with said fourth surface region being almost parallel to the direction of flow velocity of the gas in said channel.

86. (New) The ultrasonic flowmeter according to claim 85, wherein

a density ρ_1 of said first propagation medium portion and said second propagation medium portion, an acoustic velocity C_1 obtainable in said first propagation medium portion and said second propagation medium portion, a density ρ_2 of the gas, and an acoustic velocity C_2 obtainable in the gas satisfy a relation expressed as $(\rho_2/\rho_1) < (C_1/C_2) < 1$.

87. (New) An ultrasonic sensor for performing transmission or reception of an ultrasonic wave to or from a circumjacent space filled with a fluid, comprising:

an ultrasonic transducer; and

a propagation medium portion filled in a space between said ultrasonic transducer and the circumjacent space, for forming a propagation path of the ultrasonic wave, said propagation medium portion having a first surface region that faces an ultrasonic vibration surface of said ultrasonic transducer and a second surface region that faces the fluid filling the circumjacent space, with said second surface region being inclined relative to said first surface region.

88. (New) The ultrasonic sensor according to claim 87, wherein

a density ρ_1 of said propagation medium portion, an acoustic velocity C_1 obtainable in said propagation medium portion, a density ρ_2 of the fluid that fills the circumjacent space, and an acoustic velocity C_2 obtainable in the fluid that fills the circumjacent space satisfy a relation expressed as $(\rho_2/\rho_1) < (C_1/C_2) < 1$.